PUFF ROCKET

A cool way to propel yourself to new heights!

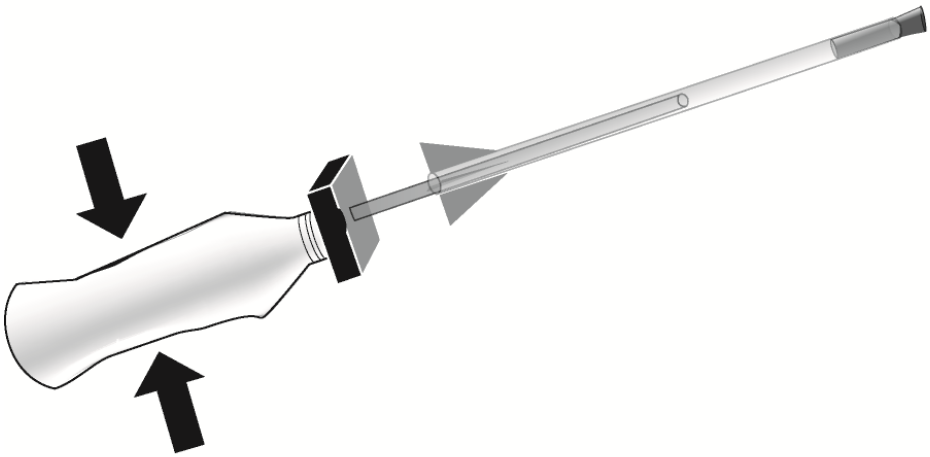
Curriculum topics:

- Forces
- Motion
- Gravity
- Newton's Laws

Subject:
Earth/Space Science
Physical Science

Grade range: K – 12

Hypothesize, experiment, collect data and analyze forces and motion with straw "rockets" and an easily made launcher. The stronger the force, the farther and higher the rocket flies! What changes can be made to improve the rocket's flight? Find out through experimentation, trials and error, and creative fun!



Who we are:

Resource Area for Teaching (RAFT) helps educators transform the learning experience by inspiring joy through hands-on learning.

For more ideas visit
https://raft.net/resources-2/

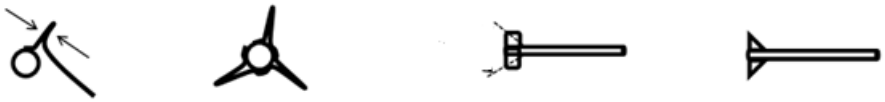
Materials required

- Plastic Bottle, squeezable (x1)
- Adhesive foam w/ hole (x1)
- Plastic straws, 2 jumbo, 1 w/ smaller diameter (3 Total)
- Foam dowel (x2)
- Adhesive labels, tape, or equivalent

WARNING: CHOKING HAZARD – Small parts not for children under 3 yrs. Adult supervision required.

Set-Up

1. Watch this video and follow along if you need visual support with set-up (YouTube 2:28, https://bit.ly/2UswyoC). Remove the release paper on the adhesive foam. Squeezing the round sides of the foam helps with peeling off the paper. Attach the adhesive foam to the bottle mouth.
2. Insert the smaller diameter straw through the hole in the adhesive foam until it feels like it is in the bottle. If you have a straw with a scoop end, insert the scoop end into the foam.
3. Press and roll a foam dowel to create a tip for the straw rocket. Insert the rolled foam dowel into one end of a larger diameter straw. Leave some foam sticking out for a safer "nose cone." Repeat for second rocket.
4. Add fins to the rocket using tape or adhesive labels (see below for an example).



Design Challenge

After building your straw rockets, test different launch angles. Modify one rocket by adding fins. Compare flights of the "control" rocket (no fins) to the modified (fin) rocket. Make other changes to the rockets and compare their flight. Try creating targets out of various materials.

To do and notice

1. Insert the open end of the straw sticking out of the bottle into the straw rocket. Make sure the straws slide together easily. If not, check that the straws are round, straight, and smooth. Adjust or replace as needed to create a loose fit.
2. Aim a straw rocket in a safe direction and give the bottle a quick squeeze. If rocket does not blast off, check to ensure a loose fit between the straws.
3. Keeping the same angle, launch a second rocket. Did one rocket fly farther or straighter? What caused the difference in performance?
4. Test different launch angles or make other physical changes to one rocket. Repeat steps 1-2. How does the flight differ between the "control" rocket and the modified rocket?
5. Explore launch variables by adjusting the depth of the launcher straw within the bottle.

Content Standards:

NGSS

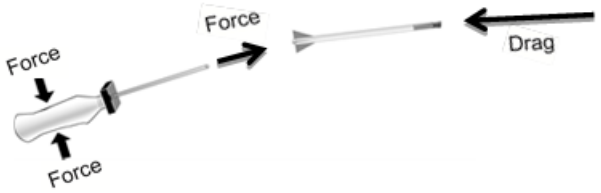
Forces & Motion:
K-PS2-1
K-PS2-2
3-PS2-1
3-PS2-2
MS-PS2-2

Kinetic & Potential Energy:
4-PS3-1
MS-PS3-5

Gravity:
5-PS2-1

The science behind the activity

Objects at rest stay at rest unless acted upon by a force. The straw rocket stays put until an unbalanced force is introduced. Squeezing the bottle puts pressurized air into the chamber formed by the two straws. When the force exerted by the pressurized air is greater than the force of gravity acting on the rocket's mass, then the rocket will move (see below). An upward-angled flight will move up and forward. All directions of motion are resisted and slowed by **drag** (air resistance). At the maximum height, the upward component of the momentum is reduced to zero by gravity and drag. The rocket continues forward, due to the remaining forward component of the momentum, and downward, due to gravity. The Puff Rocket provides learners with opportunities to use the scientific method: hypothesize, experiment, collect data, analyze, and re-test comparing control to modified rockets. They also learn some basic principles of motion. Rocket design is classic Newtonian physics in action.



Learn more

- Add a ribbon to the tail or change a variable such as fin design/material, straw length, straw diameter, angle of launch, or volume of the bottle
- Take measurements of the rocket's height and/or the landing distance from the launch point for different launch angles, or other variables
- Measure time aloft for vertical launches under different conditions

Visit **https://raft.net/resources-2/** to view the following related activities!

Catapult
Staple Remover Catapult
Foam-Tipped Stomp Rocket
Stomp Rocket
Hovercraft

Resources

See these websites for more information on the following topics:

- Balloon-Powered Rockets - https://to.pbs.org/2J8Z0qj
- Rockets 101 - https://bit.ly/2WD9qqf
- YouTube (2:28), RAFT Puff Rocket assembly - https://bit.ly/2UswyoC